FY 2004 ONGOING RESEARCH PROJECTS
DNR Groundwater Management Practice Monitoring Program
Contact: Tim Asplund (608) 267-7449

DNR Project Number 178

Title: Monitoring and Predictive Modeling of Subdivision Impacts on Groundwater in Wisconsin

Investigators: Kenneth Bradbury, University of Wisconsin-Extension, Geological and Natural History Survey and Jean Bahr, University of Wisconsin - Madison, Dept. of Geology & Geophysics

Abstract: How do unsewered rural subdivisions impact groundwater quality and quantity? The goal of this project is to develop predictive groundwater flow models - based on a field site currently under development - to aid in assessing the potential effects of rural subdivision development in south-central Wisconsin. Groundwater data, including both hydraulic and water quality parameters, will be collected before, during, and after development of a new, unsewered rural subdivision in eastern Dane County, Wisconsin. Based on data collected at this site the investigators will develop both specific and generic groundwater flow and transport models in order to predict changes in groundwater quality, groundwater levels, and groundwater flow rates at this and similar sites in glaciated landscapes. Results of this project should be of interest to land use planners and developers seeking to understand the impacts of various subdivision alternatives during rural development.

Work Location: Dane County, Wisconsin

Project Duration: July 1, 2003 to June 30, 2005

Year 1 Budget (2003-04): $35,853
Year 2 Budget (2004-05): $37,488

DNR Project Number 179

Title: Field and Laboratory Validation of Photoactivated Adsorption for Removal of Arsenic in Groundwaters

Investigator: Marc Anderson, University of Wisconsin-Madison, Dept. of Civil & Environmental Engineering

Abstract: This study will focus on the validation and application of a newly developed photoactivated adsorption technique for the removal of both Arsenic (III) and Arsenic (V) from drinking water. Two problems in the removal of arsenic from drinking water are the oxidation of As (III) to As (V) and the dependence of adsorption media on pH. Current adsorption technologies, particularly activated alumina adsorption, used by municipal drinking water facilities require a separate chemical oxidation pretreatment step and a pH adjustment for removal of arsenic. These chemical additions are expensive and a possible safety hazard, particularly for smaller communities. By utilizing a combined photocatalytic and adsorption medium, we have developed a process that simultaneously oxidizes As (III) to As (V) and

removes arsenic from water. This process eliminates the need for separate chemical oxidation and pH adjustments required for arsenic removal by activated alumina adsorption. By coating an ultraviolet-transparent support structure with a thin film of our photocatalytic adsorption medium we will create a waveguide photoreactor. We will then use this waveguide to validate the use of this technique for arsenic removal in the laboratory. Using a variety of chemical analytical techniques, we will both refine this process for arsenic removal and examine the specific surface chemistry characteristics of the adsorption process. The results of these studies will then be used to scale up this process for field studies and applications for municipal water treatment.

Work Location: University of Wisconsin - Madison

Project Duration: July 1, 2003 to June 30, 2004

Year 1 Budget (2003-04): $30,215

DNR Project Number 180

Title: Development of a Groundwater Flow Model for the Mukwonago River Watershed, Southeastern Wisconsin

Investigator: Jean Bahr, University of Wisconsin - Madison, Dept. of Geology & Geophysics

Abstract: Wetlands of the Mukwonago River watershed have been the target of conservation efforts for almost two decades. Recent suburban development has spawned a rapidly expanding commuter population and increasing demands for public water supplies, with several new high capacity wells proposed within the last year. There is a critical need to evaluate potential effects of increased pumping and reduced recharge in order to protect the springs and wetlands of this watershed. The proposed project addresses the WDNR's high priority "emerging issue"; of groundwater withdrawals and connections to surface waters. The overall objective of the proposed project is to improve understanding of hydrogeologic controls on groundwater discharge to springs and wetlands in the watershed in order to allow assessment of current and potential future impacts of groundwater withdrawals and suburban development. The primary product of the research will be a numerical model of groundwater flow. The model will be developed by a telescopic mesh refinement process and calibrated using records of water levels and synoptic stream flow measurements. The project will also provide opportunities to 1) test a conceptual model of spring localization near buried bedrock valleys, 2) assess the usefulness of a regional scale model as the basis for development of local scale models, and 3) evaluate the combined use of water levels and geochemical signatures to constrain spring water sources. Users of the findings will include concerned parties in the watershed including The Nature Conservancy and local planners.

Work Location: Madison and Mukwonago River watershed

Project Duration: July 1, 2003 to June 30, 2005

Year 1 Budget (2003-04): $29,010
Year 2 Budget (2004-05): $20,993

DNR Project Number 181

Title: Groundwater Pollutant Transfer and Export in Northern Mississippi Loess Hills Watersheds

Investigators: George J. Kraft and Bryant Browne, University of Wisconsin - Stevens Point, College of Natural Resources

Abstract: Control of nonpoint pollution sources has lagged in the 30 years since passage of the Clean Water Act. Agricultural nonpoint pollution is today the main source of impairments to the nation's ground and surface waters. Attaining control of nonpoint sources will require a better understanding of pollution transfer mechanisms and of the water quality outcomes of particular land use practices in particular settings. The groundwater transfer of nitrate, pesticide residues, and P from agricultural landscapes to surface water systems has received little attention relative to overland and shallow-subsurface (drain flow, throughflow) transfer, particularly in the Midwest. Yet a growing body of evidence suggests groundwater transfer can be substantial. This project will contribute a understanding of groundwater's role in delivering pollutants from agricultural landscapes to surface water, and of the quality of groundwater that has resulted from land management practices in the intensively cropped watersheds of the Northern Mississippi Valley Loess Hills. Specific objectives are to: 1) Gain a better understanding of the groundwater transfer of pollutants (nitrate, pesticide residues, and P) from agricultural landscapes to surface water and groundwater's role in watershed pollutant export; 2) Estimate the groundwater export of agricultural pollutants from Northern Mississippi Valley Loess Hills (NMVLH) watersheds; and 3) Assess the status and trend of agrichemical groundwater pollution in NMVLH watersheds.

Work Location: Upper Fever River Watershed

Project Duration: July 1, 2003 to June 30, 2005

Year 1 Budget (2003-04): $29,417
Year 2 Budget (2004-05): $27,350